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RECORDS OF *LIMENITIS* HYBRIDS FROM COLORADO[1]

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Documenting the occurrence of hybridization of individual animals is important because it allows the records to be utilized by individuals such as Remington (1968) who, for the first time, presented the patterns of hybridization for many invertebrates and vertebrates of the North American continent. This paper deals with four hybrid butterflies, three of which were previously unreported.

The collection of a hybrid (*Limenitis archippus* x *L. weidemeyeri*) was made by Clark Schryver on the Platte River near Denver. It was first recorded (no date) and figured by F. C. Cross (1937) who named the specimen *L. a. weidechippus* (Cross). The Entomology Museum at Colorado State University contains a specimen (Fig. 1 lower left) labeled *L. a. weidechippus* (Cross) which was collected by C. P. Gillette at Fort Collins, Colorado, on 25 August, 1894 (Acc. No. 1747). Recently, the senior author examined another specimen that was collected in Littleton, Colorado, in June 1970, by David Zielsdorf. The literature on other hybrid crosses involving *L. archippus* was reviewed recently by Shapiro and Biggs (1968) and Perkins and Gage (1970). The latter authors comment on the close resemblance of their western hybrids (*L. archippus* x *lorquini*) to the eastern hybrid (*L. archippus* x *arthemis*) (= arthechippus) reported by Shapiro and Biggs. The specimens discussed herein bear a striking similarity to those hybrids.

A hybrid (Fig. 1 lower right) between *Limenitis weidemeyeri* Edwards and *L. archippus* Cramer (Fig. 1 top left and

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Fig. 1.—*Limenitis* from Larimer and Weld Co., Colorado. Dorsal surfaces. Top left: *L. archippus* ♂, Weld Co., Colo., 3.VI.73 (TED). Top right: *L. weidemeyeri* ♂, Fort Collins, Colo., 22.VI.68 (RGS). Lower left: *L. archippus* x *weidemeyeri* ♂, Fort Collins, Colo. 25.VII.94 (CPG). Lower right: *L. archippus x weidemeyeri* ♂, Larimer Co., Colo., 9.VI.73 (RGS).

Fig. 2.—Ventral surfaces of specimens shown in Fig. 1.

top right) was collected by the senior author along the foothills near Fort Collins on 9 June, 1973. Since the specimen was in excellent condition eclosion must have occurred shortly before capture. A second specimen was observed but not netted about 20 minutes later. Their vigor was evidenced by rapid flight. There was no *L. weidemeyeri* seen flying on the day of capture. However, six days later this species was present in abundance at the collection site which was among willows surrounded, primarily, by native grassland.

This comprises four known hybrid specimens collected in the Denver-Fort Collins area over the past eighty-one years. This area lies in what is referred to as suture-zone IV by Remington (1968) which is used to denote ". . . a band, whether narrow or broad, of geographic overlap between major biotic assemblages, including some pairs of species or semispecies which hybridize in the zone".

Analysis of Characters

The following five characters, similar to those presented by Platt (1975), were used for detailed comparisons among the parental types and the hybrids: (1) traits of ground color of dorsal wings, (2) size and color of the subapical spots on forewings, (3) size and color of submarginal spots on hindwings, (4) character of postmedian white banding on wings and, (5) development of white pattern on ventral surface of abdomen.

Traits of ground color of dorsal wings. L. weidemeyeri has well-developed black pigmentation over most of the wing surface except where replaced by extensive white banding. The ground color of the wings in *L. archippus* is a rich orange. The hybrid specimens of both species are intermediate in color, but resemble the *L. archippus* phenotype more closely.

Subapical spots on forewings. The spots in the subapical area of the forewings are white (4) in *L. weidemeyeri* and orange (5) in *L. archippus.* The hybrids have five spots with a graduation in colors. The two anterior spots are white as in the *L. weidemeyeri* parent, but the three posterior spots are orange as in *L. archippus.*

Submarginal spots on the hindwings. In *L. archippus* a conspicuous black limbal line crosses each hindwing. Although present, this line is relatively indistinct in *L. weidemeyeri.* A series of spots immediately distal to the limbal line are designated as the submarginals. Each of the parental species exhibits seven orange submarginal spots which are large and quite conspicuous in *L. archippus,* but typically reduced in *L. weidemeyeri.* Both hybrid specimens are intermediate between the parents in having six moderately well-developed orange spots plus a trace of a seventh.

Postmedian white banding on wings. In *L. weidemeyeri* large white bands cross both the fore and hindwings in the postmedial regions. No such banding is present in *L. archippus.* The hybrid specimens show small white spots which represent the white bands in a reduced state. In both specimens there is a series of white spots toward the distal portion of the postmedial region, adjacent to the limbal line, on both the fore and hindwings. This suggests a development gradient of increasing influence of the *L. archippus* genome from the anterior to posterior and from wing base to wing tip.

White pattern on abdomen. The white maculae on the abdominal sternites of *L. weidemeyeri* are contiguous forming a longitudinal stripe. The pigmentation on *L. archippus* is restricted and thus forms a series of spots. The hybrids are intermediate; spots are larger than those of *L. archippus* but not sufficient to form a continuous stripe.

Discussion

An important consideration of the two Fort Collins specimens is that the *L. archippus* parent is rare in the area where the hybrids were taken. There are no records of this species from the immediate vicinity of Fort Collins. The nearest known locality in which it can be consistently collected is near Fort Morgan, Colorado, some 70 miles from the collection site of either hybrid. However, this species has been, on occasion, collected closer to Fort Collins. It can be taken along rivers in the southern and eastern portions of the state according to Brown

(1957), and along some rivers on the western slope. We conclude that both hybrids resulted from the incursion of an individual *L. archippus* into an area devoid of homospecific mates. The lack of appropriate mates resulted in reduced discrimination in the operation of the normal isolation mechanisms and hybrid matings resulted. The two hybrids seen in June of 1973 were very likely siblings since the probability of two such rare organisms occurring in such close proximity is very small unless they had a common origin.

The combinations of traits present in the hybrids pose several intriguing questions concerning the control of expression of colors and patterns. None of the traits appears to be controlled by simple mendelizing alleles. Rather, most appear to be due to systems with no genetic dominance resulting in hybrids which are intermediate between the parents.

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